



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/360,292	07/22/1999	SUJIT SHARAN	MI22-1106	3962
21567	7590	08/18/2004		
WELLS ST. JOHN P.S. 601 W. FIRST AVENUE, SUITE 1300 SPOKANE, WA 99201			EXAMINER AHMED, SHAMIM	
			ART UNIT	PAPER NUMBER
			1765	

DATE MAILED: 08/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

**Application No.**

09/360,292

**Applicant(s)**

SHARAN ET AL.

**Examiner**

Shamim Ahmed

**Art Unit**

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 15 June 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 15-24 and 35-41 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 15-24 and 35-41 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 6/15/04.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Response to Arguments***

1. Applicant's arguments filed 6/15/04 have been fully considered but they are not persuasive.

Applicants argue that the teaching of treating aluminum-containing wiring film with an oxygen-comprising plasma of Fukuyama et al do not provide any contribution to remove residue from an outwardly exposed silicon-comprising material as suggested in the claim 15.

In response to the applicant's argument, examiner states that the substrate is treated to be remove the residue that is remain after an etching of a sample (silicon wafer) on which aluminum-containing wiring film is formed by heat oxidized film of silicon oxide ( $\text{SiO}_2$ ) on the silicon substrate (col.3, lines 54-55, col.4, lines 63-64 and col.5, lines 7-9).

Therefore, the sample including the aluminum-containing wiring is silicon-comprising and which sample is treated with the oxygen-comprising plasma to remove the residual matter.

So, the rejections of the previous office action are maintained and repeated here in as below.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

Art Unit: 1765

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 15-18,20,22,35,38-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mathews et al (5,658,829) in view of Fukuyama et al (5,770,100).

Mathews et al disclose a method of forming a contact to a silicon substrate (36), wherein a contact opening is formed by etching an insulating layer (40) through a patterned/masked layer (42) over the silicon substrate and the etching extending the opening to expose outwardly a silicon comprising material as an active region (38) at the base of the opening (col3, lines 21-40 and figure 4).

Mathews et al also disclose that the masking layer is removed using oxygen etching/ashing after the etching process, which forms the contact opening (44) (col.3, lines 43-45 and figure 5).

Mathews et al teach that after removing the masking layer, conductive layer (52,54) is subsequently deposited (col.3, line 65-col.4, line 6 and figure 6).

Mathews et al fail to disclose the introduction of an oxygen-comprising plasma cleaning step to remove a residue from the outwardly exposed silicon-comprising material before the subsequently deposition.

However, in a post-etch treatment method, Fukuyama et al teach that the etched substrate is treated with oxygen-comprising plasma such as ozone ( $O_3$ ), oxygen for removing residual matter (col.7, lines 7-24).

Therefore, it would have been obvious to one of ordinary skilled in the art at the time of claimed invention to combine Fukuyama et al's teaching into Mathews et al's process for efficiently removing the residual masking material as taught by Fukuyama et al.

By doing so, one could have a residue-free substrate that will assure the subsequent deposition process is contamination-free.

As to claims 17-18 and 20, Fukuyama et al teach that the plasma comprises hydrogen ( $H_2$ ) (col.7, lines 10-24).

As to claim 35, modified Mathews et al discussed above and Mathews et al also disclose that etching the material 40 comprises BPSG immediately beneath the masking material 42 of photoresist (col.3, lines 26-32).

Modified Mathews et al do not explicitly teach that the plasma etching for the carbon- containing polymer residue is substantially selectively relative to the BPSG layer and relative to the silicon-comprising layer.

However, Mathews et al teach that the etching of the BPSG layer is performed using carbon/fluorine based chemistry, it would have been obvious that the residue formed after etching is carbon-containing polymer (col.3, lines 38-40).

Additionally, Fukuyama et al teach that plasma etching is performed to remove selectively the carbon-containing resist residual material ((col.7, lines 7-24), which reads on the limitation of plasma etching the carbon-containing polymer relative to the BPSG material and the silicon-comprising material because Fukuyama et al's post-etch treatment process is designed for efficiently removing the residual material.

As to claim 38, Fukuyama et al teach that the etched substrate is treated with oxygen-comprising plasma such as ozone ( $O_3$ ), oxygen for removing residual matter (col.7, lines 7-24).

As to claims 39-40, Fukuyama et al teach that the plasma comprises hydrogen ( $H_2$ ) (col.7, lines 10-24).

5. Claims 21,36-37 rejected under 35 U.S.C. 103(a) as being unpatentable over Mathews et al (5,658,829) in view of Fukuyama et al (5,770,100) as applied to claims 15-18,20,22,35,38-40 above, and further in view of Brown et al (5,780,359).

Modified Mathews et al discussed above in the paragraph 4 but fail to teach the temperature is at least 400 degree and at least 600 degree C.

However, in a method of removing polymer residue from the surface and sidewalls of a silicon wafer, Brown et al teach that the temperature of the stripping process can be varied from 20 degrees to over 100 degrees C, while the benefits of

Art Unit: 1765

using higher temperatures includes a rate increase in the chemical portion of the stripping process (col.4, lines 26-33).

Therefore, it would have been obvious to one skill I the art at the time of claimed invention to optimize the process temperature to an elevated one because the elevated temperature will increase the rate of reaction of the stripping process as taught by Brown et al.

6. Claims 19 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mathews et al (5,658,829) in view of Fukuyama et al (5,770,100) as applied to claims 15-18,20,22,35,38-40 above, and further in view of Nagashima et al (5,129,958).

Modified Mathews et al discussed above in the paragraph 4 but fail to teach that the hydrogen comprising gas is  $\text{NH}_3$ .

However, in a cleaning process for residue after fluorine plasma, Nagashima et al teach that both ammonia and hydrogen can be used as a reducing gas for efficiently cleaning the residue (col.2, lines 41-50).

Therefore, it would have been obvious to one skilled in the art at the time of claimed invention to combine Nagashima et al's teaching into modified Mathews et al's method for efficiently removing the remnant resist material because both the ammonia ( $\text{NH}_3$ ) and hydrogen gas are functionally equivalent as taught by Nagashima et al.

7. Claims 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mathews et al (5,658,829) in view of Fukuyama et al (5,770,100) and further in view of Chen et al (5,704,986).

Modified Mathews et al discussed above in the paragraph 4 but fail to teach the introduction of at least two plasma etching using different gas chemistries and specially the at least two plasma etching comprises first oxygen comprising and another is chlorine gas comprising.

However, Chen et al disclose a cleaning process for removing organic contaminant residue, wherein the cleaning process comprises:

A plasma comprises a first oxidant gas such as oxygen and subsequently supplying a gas comprises chlorine for enhancing the cleaning process by volatilizing the contaminants residue from the substrate to be cleaned, wherein the temperature is maintained below 800 degree C (col.4, lines 31-55, and col.6, lines 64-col.7, lines 45).

Therefore, it would have been obvious to one skilled in the art at the time of claimed invention to combine Chen et al's teaching into modified Mathews et al's method for an improved cleaning process in order to efficiently removing the organic and metal contaminants from the substrate to be cleaned as taught by Chen et al.

#### ***Remarks***

In the previous office action, examiner inadvertently omitted to mention that "claims 23-24 are rejected over Mathews et al (5,658,829) in view Fukuyama et al (5,770,100) and further in view of Chen et al (5,704,986) " but in the rejection body relied upon the previous paragraph 5, which paragraph discusses Mathews et al in view of Fukuyama et al (see paragraphs 5 and 8 of the previous office action).

Therefore, the change in the paragraph 7 above is a clarification of the previous office action, specifically for the paragraph 8 of the previous office action, mailed



Art Unit: 1765

3/15/2004 in such that the claims 23-24 are rejected over Mathews et al in view of Fukuyama et al and further in view of Chen et al.

***Conclusion***

**8. THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shamim Ahmed whose telephone number is (571) 272-1457. The examiner can normally be reached on M-Thu (7:00-5:30) Every Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 1765

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Shamim Ahmed  
Examiner  
Art Unit 1765

SA  
August 14, 2004